OVERVIEW OF THE STATUS OF CHEMICAL DEMILITARISATION WORLDWIDE, AND THE WAY AHEAD

By Ron Manley

The OPCW has come a long way in the three years since the entry into force (EIF) of the Chemical Weapons Convention, and we are steadily moving towards the achievement of the Convention's ultimate objectives.

General

Today, 135 States have committed themselves to the goals of the CWC. What does this impressive number of States Parties mean in concrete terms? In short, it means that the majority of the world's known stockpiles of chemical weapons and production capabilities are now subject to the CWC's verification regime. A further 37 States have signed the Convention – thereby identifying themselves with its object and purpose – but have yet to complete the legislative and legal steps necessary to obtain full membership. This means that only about 20 countries remain entirely outside the influence of the Convention. The members of the Organisation are continuing to make strenuous efforts to bring these remaining countries into the fold, and it is our firm belief that our membership will continue to grow and that the OPCW will, within the foreseeable future, achieve its ultimate aim of universal membership.

The provisions of the CWC are focused on a broad spectrum of issues related to the complete elimination of existing chemical weapons (CW) stockpiles and their associated production facilities. The general provisions for CW destruction, and for the implementation of the verification regime relating to their destruction, are stipulated in Article IV of the Convention and Part IV(A) of its Verification Annex. Those for the associated chemical weapons production facilities (CWPFs) are set out in Article V of the Convention and Part V of the Verification Annex.

Existing CW Stockpiles and Progress in National CW Destruction Programmes

Since the EIF of the Convention, the OPCW has been successfully applying the verification regime at CW-related facilities. This regime is divided into four main programmes, including the verification of modern (post-1946) CW stockpiles located at CW storage facilities (CWSFs), the verification of the destruction of such chemical weapons at chemical weapon destruction facilities (CWDFs), the verification and destruction of (pre-1946) old and abandoned chemical weapons (OACW), and the destruction/conversion of former chemical weapons production facilities (CWPFs). The systematic verification of the destruction of chemical weapons is a core element of the verification regime.

The Convention does not establish any specific requirements in relation to the type of technology to be employed to destroy chemical weapons, but it does stipulate the main principles to be adopted. Each State Party may determine how it shall destroy its declared CW stockpile, and may select the most appropriate technology on the basis of existing resources, qualified personnel, technical experience, and budgetary concerns. Operations at CWDFs must, however, also be carried out in accordance with national safety standards and environmental requirements. All processes, however, must satisfy the following definition from paragraph 12 of Part IV(A) of the Verification Annex: 'chemicals are converted in an essentially irreversible way to a form unsuitable for production of CW

and which in an irreversible manner renders munitions and other devices unusable as such.'

Four States Parties have declared CW stockpiles, and have informed the Secretariat of their long-term plans to perform CW destruction operations at up to 34 CWDFs. These facilities, which cover all the various categories of chemical weapons, include continuously and non-continuously operating facilities, as well as mobile CW destruction units. When changes to national programmes occur that affect the annual destruction plans of a given State Party, it is required to notify the Secretariat promptly.

In accordance with the national declarations, destruction at CWDFs of chemical weapons in Categories 1, 2 and 3 will total approximately 70,000 tons of CW agents, including approximately 8.4 million filled CW munitions/containers. The bulk of the declared CW stocks are held by the Russian Federation and the United States of America. As of July 2000, 4,790 metric tonnes (MT) of CW agents and 1.3 million CW filled munitions/containers had been irreversibly destroyed in the presence of OPCW inspection teams–approximately 4,029 MT of nerve agents (GB,VX), 226 MT of blister agents (HD), 1 MT of precursors (QL, DF), 464 MT of binary CW, and 70 MT of Category 2 CW.

The discovery of additional old and abandoned chemical weapons is an ongoing and unpredictable process.

Past experience has shown that the issues of national legislation and of the selection of the CW disposal technology, including its comprehensive consideration and assessment, testing and sub-sequent adoption, followed by the design and construction of the CWDF, are both a time- and resource-consuming process. The Convention stipulates a relatively short time period – ending in 2007, 10 years after the EIF of the Convention in 1997 – within which the existing CW stockpiles are to be destroyed.

The CW destruction facilities must satisfy any possible public concerns (i.e. they must operate in a safe manner in order to avoid a release of CW agent into the environment). They must reduce to the minimum extent possible the level of risk associated with the transportation of these hazardous agents, and must also avoid any negative impact on the local infrastructure. This has sometimes contributed to significant delays in the CW destruction programme of some States Parties. Provided that the appropriate safety and environmental protection measures are in place destruction is without question the safest option, as continued storage will result in the gradual deterioration of CW stockpiles which will, in turn, inevitably increase the risk of an accidental release of chemical agent.

An on-site disposal concept has been adopted by all the declared CW possessor States Parties. In particular, this approach is planned to be applied to all seven continental CW destruction facilities, as well as to the Johnston Atoll Chemical Disposal System in the United States of America, and also to the seven planned major CW destruction facilities in the Russian Federation. The United States of America has adopted the incineration of CW agents and the thermal treatment of the associated metal parts as its baseline technology. An investigation into possible alternative, new technologies, is, however, now under way in the United States. In the Russian Federation, research and development on CW destruction originally focused on low-temperature destruction processes and the ability to recycle some valuable components such as arsenic (As) –as, for example, in the case of the disposal of lewisite. It should be stressed that, while the Secretariat's function is not to influence a State Party's selection of the technology for CW destruction, the Secretariat is obliged to be familiar with the technology as a whole, including the design and capacity of the destruction facility/units, and to take into account specific features of the technological process in order to correctly develop and apply the on-site verification regime. In order to ensure a robust and effective verification regime both sides need to review and discuss the general procedures for CW delivery, temporary storage and inventory, in addition to agreeing upon the end-points of destruction, in relation to the CW agent and the metal parts. As stipulated in the Convention, the State Party should provide both detailed facility information and any additional information on the improvement of existing methods and the development of new methods for the destruction of CW.

The current situation in relation to the destruction of chemical weapons is that all four of the States Parties which declared the possession of chemical weapons have begun, in one form or another, to destroy their respective stockpiles. To date, as much as 67% of OPCW inspector days have been spent at destruction facilities, which means that a considerable proportion of the available inspector resources are being utilised to continuously monitor the destruction of chemical weapons. Moreover, as destruction operations in declared possessor States Parties gather momentum, the requirements for monitoring operating destruction facilities will continue to increase substantially. The Secretariat and Member States are therefore currently exploring the possibility of new operational concepts for monitoring destruction operations which, while ensuring maintenance of the required degree of confidence, will, at the same time, allow the Secretariat to continue to meet its other verification responsibilities with the available inspector resources.

The United States of America has taken a leading role in the destruction of chemical weapons, and has significantly

moved ahead of the CW destruction schedule established by the Convention. Since EIF, this State Party has destroyed more than 16% of its CW stockpile. It should also be noted that the first United States CWDF prototype plant at Johnston Atoll (JACADS) is rapidly approaching its last destruction campaign, and should complete its tasks by the beginning of next year.

In 1999, the United States successfully completed the destruction of 258,548 binary projectiles and 457.6 MT of one of the two chemical components used in this weapon system. The success of this campaign can be attributed in part to the cooperation extended by both sides to the establishment of on-site verification procedures, including the selection and installation of monitoring equipment. The lessons learned from this campaign were taken into account when verification activities at other CWDF facilities were being planned.

In 1999, India and another State Party destroyed more than 1% of their declared stockpiles, thus meeting the requirements of the Convention for the first phase of Category 1 CW destruction. Both of these States Parties, along with the United States, will now proceed with the Phase II requirement of the Convention – the destruction of 20% of their CW by 29 April 2002.

The situation in the Russian Federation is, however, more problematic. Due to economic difficulties, the Russian Federation was unable to meet this important deadline, and the Conference of the States Parties, at its Fifth Session in May of this year, decided to grant an extension to the Russian Federation's obligation to meet the intermediate deadline for the destruction of 1 percent of its Category 1 chemical weapons stockpiles. The Russian Federation nevertheless remains firmly committed to the CWC, as is clearly attested by its recent actions. Russia has submitted to the Secretariat plans for the destruction of Category 3 chemical weapons – i.e. of powder and burster charges for chemical munitions. As for the broader issue of the elimination of Russia's stockpile of Category 1 chemical weapons, substantial international assistance will be needed to ensure their destruction within the timelines provided for in the Convention. The commencement of Category 1 destruction at the Gorny CWDF is currently planned for the fourth quarter of 2001.

CW Stockpile Destruction Technologies

The level of technical innovation in the field of CW destruction is very high. This was demonstrated during the presentations given at the recent DERA Conference (CWD 2000) held in The Hague, in May of this year. A large variety of destruction technologies can, in theory, be applied to the destruction of chemical weapons. The selection, evaluation and assessment of a given technology is based on its level of development, as well as on the reliability and stability of its operational parameters. The type of CW agent and the mode of CW agent storage (containers or munitions) must also be taken into account. Assembled chemical munitions (projectiles, mortars, mines, rockets) require mechanical operations (reverse assembly, drilling, cutting, etc.) in order to facilitate access to the internal cavity, so that the liquid or solid chemical agent can be removed for final destruction. This dismantling operation includes the separation of the resulting materials (toxic agent, explosives, metal parts, fuzes, burster charges) and their final disposal within different process streams. These principles have all been applied in the baseline incineration technology currently in use in the USA.

Since the EIF of the Convention, the overwhelming amount of CW agent processed has been destroyed by incineration, with the subsequent thermal treatment of the associated metal parts. This method of destruction is expected to continue to be the dominant process in the near future, as this technology is applicable to the United States facilities at TOCDF – scheduled to operate until 2003 (42.3% of the US stockpile), as well as to the three new US CWDFs located in Anniston (7.1% of the US stockpile), Umatilla (11.6% of the US stockpile), and Pine Bluff (12% of the US stockpile). A shift in the balance between incineration and alternative technologies within the United States is expected with the commencement of CW destruction at the two CWDFs planned to be located in Newport, Indiana, and Aberdeen, Maryland. The new technologies are likely to be based on CW agent hydrolysis followed by further post-treatment of the products (e.g. super critical water oxidation/ biodegradation).

In the Russian Federation, the first large-scale CW destruction facility (currently under construction at Gorny) will use alkaline hydrolysis and/or ammonolysis of the lewisite followed by electrolysis, thus permitting the recovery of the arsenic. Another planned large-scale continuously operating facility destroying nerve agents will use low-temperature neutralisation technology, followed by the solidification of the reaction products.

The destruction of CWPFs or their conversion for peaceful purposes is emerging as a problem of technical complexity comparable to that of the destruction of chemical weapons.

CW destruction technology continues to be developed and, as in the case of other industrial facilities, all technologies are likely to be upgraded or modified on the basis of new research and develop-ment and the introduction of more advanced technologies.

Some technical challenges are related to the condition of the CW stockpiles. These may influence the application of the verification regime on site. For example, the processing and quantification of the viscous CW agents is not easy. In many cases, the condition of CW agent (particularly mustard gas) which has been stored for a long period is such that it often cannot be completely drained from a bulk storage tank or munition. In the case of artillery munitions (projectiles, mortars), complete thermal treatment may, in the worst case, need to be performed without any prior draining of the CW agent.

Approaches to the Destruction of Old/Abandoned CW

As a result of the extensive production, transfer and storage of chemical weapons during the First and Second World Wars, and the large-scale use of CW during World War I, the problem of old and abandoned chemical weapons now confronts many countries. Certain activities related to the disposal of OCW are an integral part of national programmes relating to both the clearing of test ranges and soil reclamation. The discovery of additional old and abandoned chemical weapons is an ongoing and unpredictable process. Most are obsolete, and many are leaking. Often there is no indication of either the kind of chemical agent which they contain or their origin. Although such OACW do not pose a significant threat to the object and purpose of the Convention, they do pose a threat to the environment, and States Parties remain responsible for their safe destruction when they discovered.

Eleven States Parties have so far declared approximately 40 sites as containing OACW, more than 30 of which have received inspections. A number of countries had successfully carried out destruction programmes for OCW even before the entry into force of the Convention. In Indonesia, for example, Dutch and Indonesian experts had by 1979 completed the destruction by incineration of 45 MT of bulk mustard produced by the Dutch in the 1940s. Also, in the early 1990s, Canada completed the destruction of its mustard and lewisite stocks and of a small quantity of nerve agent. Destruction operations for OCW have been ongoing in Belgium, Germany, Italy and the United Kingdom of Great Britain and Northern Ireland, for example, for a number of years.

Most countries use similar methods for the recovery and destruction of old chemical weapons. These methods involve investigating the site and locating the weapons, unearthing and identifying the recovered munitions, and removing and transporting them to a temporary storage facility. Prior to demilitarisation there is usually a preparation phase consisting of cleaning (e.g. using a high-pressure water jet or blasting with pellets of solid carbon dioxide) and X-raying each item individually to assess its internal structure. With regard to the technologies used to destroy old chemical munitions, the general approach taken by different States Parties involves the mechanical disassembly of individual munitions – a time-consuming and hazardous process – followed by thermal (incineration) or chemical (neutralisation) treatment of the chemical agent and contaminated scrap. The final disposal of all explosive components is generally performed by explosive detonation.

In the United States, the destruction of recovered CW munitions is covered by the national non-stockpile chemical material programme. Mobile CW destruction systems are being developed for this purpose. The first mobile system, MMD-1, is under final testing before it becomes operational at Dugway Proving Ground. The US is also developing a transportable emergency destruction system (EDS) to treat recovered chemical warfare materials. This system is designed to treat explosively configured chemical munitions that are deemed unsafe for mechanical handling or transport.

The possibility of using new technologies is much higher at small-scale OACW destruction installations, in comparison with the large-scale continuously operating facilities designed for the destruction of modern chemical weapons. The destruction site in Civitaveccia, Italy, for example, includes three plants for OCW destruction: the mustard gas (HD)/phenyldichloroarsine (PD) destruction plant, the adamsite demilitarisation plant, and the ammunition dis-charging plant. The mixtures of HD and PD are destroyed by the liquid phase oxidation of the mixture by concentrated